PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

CALOMA CREEK BASIN
JONES MEADOW DAM
GREENOUGH, MONTANA
MT-1159

PREPARED FOR:

THE HONORABLE TED SCHWINDEN
GOVERNOR OF THE STATE OF MONTANA

LINDBERG CATTLE COMPANY
(OWNER AND OPERATOR)

PREPARED BY:

MORRISON - MAIERLE, INC.
CONSULTING ENGINEERS

APRIL, 1981

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EXECUTIVE SUMMARY

Under contract with the State of Montana Department of Natural Resources and Conservation and with representation from Department of Natural Resources and Conservation and the Lindberg Cattle Company, Morrison-Maierle, Inc. inspected Jones Meadow Dam on 17 July 1980 under the authority of Public Law 92-367. The dam is located on Coloma Creek, a tributary to Elk Creek and the Blackfoot River in Missoula County about 1.5 miles south of Greenough and 26 miles east of Missoula, Montana.

This report was compiled from information obtained during onsite inspection, review of construction plans, and analysis of available hydrologic information. Findings were compared with engineering criteria that are currently accepted by most private and public agencies engaged in dam design, construction, and operation.

FINDINGS AND EVALUATION

Jones Meadow Dam is owned and operated by the Lindberg Cattle Company. The dam and reservoir are located on private land and the reservoir is used solely for storage of irrigation waters. The 33.5-foot high earth dam (hydraulic height), designed by the U.S. Soil Conservation Service, impounds 209 acre-feet of water at the dam crest, assumed elevation 4035.0 feet National Geodetic Vertical Datum (NGVD). All elevations used in this report are based on assumed elevation 4001.5 feet at the flow line of the outlet pipe at the toe of the dam which corresponds to a project datum elevation of 89.5 feet on the construction plans.

On the basis of criteria in U.S. Army Corps of Engineers Recommended Guidelines for Safety Inspection of Dams (Reference 1), the project is small in size. The dam is located such that its failure could endanger a few lives and cause excessive economic loss. However, no dam breach analysis or routing of a dam breach flood was made for the downstream area. The conclusions on probable damage are based on a brief field visit and engineering judgement.

The project is classified as having a high (Category 1) downstream hazard potential. Inspection criteria (Reference 1) recommend that a small size project with a high downstream hazard potential be capable of safely handling from one-half the probable maximum flood (PMF) to the full PMF. The PMF is the flood expected from the most severe combination of meteorologic and hydrologic conditions that are reasonably possible in the region.

Based on the finding of this Phase I Inspection, the one-half PMF is recommended as the spillway design flood (SDF) for this project because of the relatively low risk to inhabitable structures (two or less inhabitable structures) located downstream.

An estimated thunderstorm PMF was developed for the 2.16 square mile drainage basin during this dam safety study. The PMF resulting from the 6-hour thunderstorm has an estimated volume of 1,040 acre-feet and a peak flow of 15,100 cfs. The emergency spillway has a maximum discharge capacity of 550 cfs with the reservoir at assumed top of dam, elevation 4035.0 feet. The routing of the PMF was started with the reservoir 1.0 feet below the emergency spillway crest (0.8 feet above the principal spillway crest elevation). The routing indicates that the dam is overtopped during the PMF when approximately 9% of the PMF volume enters the reservoir. The dam is constructed of materials that would quickly erode and rapidly fail when overtopped by floodwaters. Such failure could endanger lives at the Lindberg ranch area at Greenough and cause extensive damage to state primary highway 200, ranch property and buildings.

There is insufficient data available to evaluate the embankment stability.

On the basis of the field inspection and study of hydrologic data, Jones Meadow Dam does not now conform to Corps guidelines with respect to discharge and/or storage capacities to safely handle the recommended spillway design flood (SDF).

RECOMMENDATIONS

A downstream warning plan for use in the event of possible dam overtopping or structural failure needs to be developed and immediately placed in action. Inspect the upstream impervious blanket, which was placed at the left (south) abutment to control seepage in that area, for evidence of erosion or deterioration which might result in increased seepage. Remove small fir trees and brush on the embankment slopes and backfill and compact disturbed areas. Periodically inspect the downstream slope, toe and abutment areas for changes in seepage conditions.

Conduct more detailed hydrologic and hydraulic routing studies to better determine downstream hazard and required spillway capacity and modify the project as studies indicate. Evaluate embankment stability and modify the project as studies indicate. Have inspections of the project conducted at not less than five year intervals by geotechnical engineers experienced in dam design and construction.

Prior to performing engineering studies and remedial construction, all work should be coordinated with the State of Montana, Department of Natural Resources and Conservation to insure compliance with all pertinent laws and regulations.

Rodger C. Foster
Professional Engineer

PERTINENT DATA
Jones Meadow Dam

1.	GENERAL	
	Federal ID No.	MT-1159
	Owner	Land M. Lindberg Lindberg Cattle Company
	Operator	Lindberg Cattle Company
	Date Constructed	1964
	Purpose	Irrigation
	Location	Section 12, T13N, R15W Principal Meridian Latitude 46°53'45" Longitude 113°25'53"
	County, State	Missoula County, Montana
	Watershed	Caloma Creek
	Size	Small
	Downstream Hazard Potential	Category 1, High
	USGS Quadrangle	Greenough
2.	RESERVOIR	
	Surface Area at Emergency Spillway Crest	15.8 acres
	Drainage Area	2.16 square miles
	Storage at Emergency Spillway Crest, 119.0 feet project datum (estimated elevation of 4031.0 feet NGVD)	133 acre-feet
	Storage at Dam Crest, 123.0 feet project datum (estimated elevation of 4035.0 feet NGVD)	209 acre-feet
	Surcharge Storage	76 acre-feet
3.	EMERGENCY SPILLWAY	
	Type	Unlined chute with 50-foot level control section
	Bottom Width	25 feet

Crest Elevation	119 feet project datum (4031.0 feet NGVD)
Capacity with Reservoir at Dam Crest	550 cfs

4. OUTLET WORKS/PRINCIPAL SPILLWAY

Conduit	15-inch diameter corrugated metal pipe (CMP).
Riser	24-inch diameter CMP connected to 15-inch diameter CMP as principal spillway
Crest elevation of drop inlet	117.2 feet project datum (estimated elevation 4029.2 feet NGVD)
Conduit length	164 feet of 15-inch pipe
Gate	15-inch diameter slide gate
Capacity with Reservoir at Dam Crest	17 cfs

5. DAM

Type	Rolled earth
Length	275 feet
Crest Breadth	varies, 15 to 17 feet
Crest Elevation	123 feet project datum (estimated elevation 4035.0 NGVD)
Hydraulic Height Crest to Toe	33.5 feet
Upstream Slope	1 V on 3 H
Downstream Slope	1 V on 2 H

Chapter 1
BACKGROUND

1.1 INTRODUCTION

1.1.1 Authority and Scope

This report summarizes the Phase I inspection and evaluation of the Jones Meadow Dam, owned by the Lindberg Cattle Company.

The National Dam Inspection Act, Public Law 92-367 dated 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to conduct safety inspections of non-Federal dams throughout the United States. Pursuant to that authority, the Chief of Engineers issued "Recommended Guidelines for Safety Inspection of Dams" in Appendix D, Volume 1 of the U.S. Army Corps of Engineers' report to the United States Congress on "National Program of Inspection of Dams" in May 1975.

The recommended guidelines were prepared with the help of engineers and scientists highly experienced in dam safety from many Federal and state agencies, professional engineering organizations and private engineering consulting firms. Consequently, the evaluation criteria presented in the guidelines represent the comprehensive consensus of the engineering community.

Where necessary, the guidelines recommend a two-phased study procedure for investigation and evaluation of existing dam conditions, so deficiencies and hazardous conditions can be readily identified and corrected. The Phase I study is:

(1) a limited investigation to assess the general safety condition of the dam.

(2) based upon an evaluation of the available data and a visual inspection.

(3) performed to determine if any needed emergency measures and/or if additional studies, investigations, and analyses are necessary or warranted.

(4) not intended to include extensive explorations and analyses or to provide detailed alternative correction recommendations.

The Phase II investigation includes all additional studies necessary to evaluate the safety of the dam. Included in Phase II, as required, should be additional visual inspections, measurements, foundation exploration and testing, material testing, hydraulic and hydrologic analyses, and structural stability analyses.

The authority for the Corps of Engineers to participate in the inspection of non-federally-owned dams is limited to Phase I investigations with the exception of situations of extreme emergency. In these cases, the Corps may proceed with Phase II studies but only to the extent needed to answer serious questions relating to dam safety that cannot be answered

otherwise. The two phases of investigation outlined above are intended only to evaluate project safety and do not encompass in scope the engineering required to perform design or corrective modification work. Recommendations contained in this report may be for either Phase II safety analyses or detailed design study for corrective work.

The responsibility for implementation of these Phase I recommendations rests with the dam owner and the State of Montana. It should be noted that nothing contained in the National Dam Inspection Act, and no action or failure to act under this Act shall be construed (1) to create liability in the United States or its officers or employees for the recovery of damage caused by such action or failure to act or (2) to relieve an owner or operator of a dam of the legal duties, obligations, or liabilities incident to the ownership or operation of the dam.

1.1.2 Purpose

The purpose of the inspection and evaluation is to identify conditions that threaten public safety, so that they may be corrected in a timely manner by non-Federal interests.

1.1.3 Inspection

The findings and recommendations in this report are based on a brief visual inspection of the project and a detailed review of available construction plans. Inspection procedures and criteria are those established by the Recommended Guidelines for Safety Inspection of Dams (Reference 1).

Personnel present during the inspection included:

Art Taylor	Civil Engineer, State of Montana, Department of Natural Resources and Conservation
Rodger Foster	Team Leader, Morrison-Maierle, Inc., Water Resource Engineer
Mike Kaczmarek	Engineering Geologist, Morrison-Maierle, Inc.

Mrs. Land Lindberg accompanied the inspection team to the dam site and provided introductory information. She did not remain for the inspection. An exit interview was held with Mr. Land Lindberg upon the completion of the on-site inspection.

Additional Morrison-Maierle personnel who contributed to the evaluation are

Bill Keith	Structural Engineer
Ken Salo	Hydrologist/Hydraulics Engineer.

This report has been reviewed by representatives of the Montana Department of Natural Resources and Conservation and the Soil Conservation Service, whose written responses are included in the Appendix.

1.2 DESCRIPTION OF PROJECT

1.2.1 General

Jones Meadow Dam is located on Coloma Creek, a tributary of Elk Creek, in Missoula County, Montana approximately 26 miles east of Missoula and 1.5 miles south of Greenough (Plates 1 and 2). The project's Federal identification number is MT-1159. The dam and reservoir are located entirely on the property of Lindberg Cattle Company about 1.5 miles upstream of the ranch complex at Greenough. The 33.5-foot high (hydraulic height) earth dam impounds approximately 209 acre-feet at the dam crest, assumed elevation 4035.0 feet NGVD. All elevations used in this report are based on assumed elevation 4001.5 feet NGVD for the flow line of the outlet pipe at the toe of the dam which corresponds to a project datum elevation of 89.5 feet on the construction plans.

Based on visual reconnaissance and engineering judgement, approximately one residential home, several farm buildings, an old school house, the heavily traveled Montana Highway 200, and miscellaneous property would be affected by a sudden breach of Jones Meadow Dam. On the basis of this information and in accordance with the recommended guidelines, the project size is classified as small and the downstream hazard potential is high (Category 1).

The 215-foot long, 25-foot wide, uncontrolled, unlined spillway chute is located in the left (south) abutment of the dam (Plate 3 and Photos 9, 10, 11 and 12).

The low level outlet and the principal spillway are combined into a single outlet conduit located approximately 60 feet from the right (north) abutment (See Plate 4 and Photo 13). The outlet conduit is a 15-inch diameter corrugated metal pipe (CMP). The flow is controlled by a 15-inch diameter slide gate at the toe of the upstream slope. The principal spillway is a 24-inch diameter, corrugated metal, vertical riser pipe located 29 feet upstream of the centerline of the dam. The riser connects as an uncontrolled drop inlet to the outlet conduit (Plate 3).

1.2.2 Regional Geology and Seismicity

Jones Meadow Dam and Reservoir are located on the north slope of the Garnet Range. The northwest side of the Garnet Range consists mainly of slightly metamorphosed Precambrian sedimentary rocks of the Belt Supergroup, traditionally referred to as the Belt Series prior to 1961 (Reference 2). The Belt metasediments are intruded by a number of igneous rock bodies, the largest being the Garnet stock about three miles southeast of the Jones Meadow Dam. Nearly horizontal strata of semi-consolidated mudstone, sandstone, and conglomerate of Tertiary Age unconformably overlie the Belt strata and intrusive rocks at elevations up to about 4200 feet.

Streams tributary to the Blackfoot River were not glaciated and have deposited unconsolidated sand and gravel alluvium in their stream beds. The alluvium is derived from recently eroded bedrock and Tertiary sediments and overlies both Belt metasediments and Tertiary sediments. Unstratified glacial drift and stratified lacustrine clay and silt (Glacial Lake Missoula sediments) are present along the Blackfoot River and areas farther north, but are not present on the north slope of the Garnet Range.

The Belt metasedimentary rocks along the north slope of the Garnet Range are deformed by broad, open northwest-trending folds. Compressive forces along the folds were relieved by northwest-trending thrust faults that are cut by younger high-angle normal faults. The major structures near the Jones Meadow Dam consist of an east-southeast plunging syncline, referred to as the Elk Creek syncline (Reference 3), and an east-west trending normal fault (Reference 3) that separates the generally south-dipping rocks at the dam and reservoir from the Elk Creek syncline to the south. The normal fault is concealed under Tertiary sediments at Jones Meadow where the projected fault trace passes near the upstream end of the Jones Meadow Reservoir area.

The Jones Meadow Dam and Reservoir are located in seismic probability Zone 2 (Reference 1). Seismic probabilities used herein divide the United States into four seismic risk zones based on the record of the severity of ground shaking and the reasonable expectancy of earthquake damage. Seismic probability Zone 2 indicates that earthquakes with potential for moderate damage may occur. Zone 2 corresponds to a potential intensity of VII on the Modified Mercalli intensity scale of 1931. In accordance with recommended guidelines (Reference 1), the hazard of seismic loading and resultant embankment shear failure is considered to be negligable in seismic probability Zone 2 provided static stability conforms with accepted safety margins.

1.2.3 Site Geology

The left and right abutments at the Jones Meadow Dam consist of a light gray, thin bedded, banded siltite and quartzite. The quartzite is fine to very fine-grained and the siltite and quartzite exhibit laminar to low angle internal crossbeds. The siltite and quartzite are very hard and resistant to weathering. Joints on about 12-inch spacings are oriented perpendicular to bedding planes and result in blocky splitting characteristics. Average dimensions of the blocks are 12 inches or less. The beds dip 20 degrees west-southwest and strike S 15° E. The spillway section on the left abutment is cut through the hard siltite and quartzite and is supported throughout most of the spillway length by the bedrock.

The bedrock in the foundation of the dam is overlain by relatively coarse-grained sand and gravel allivium of unknown thickness. The reservoir area is bounded by Tertiary sediments of unknown thickness that consist chiefly of horizontally stratified siltstone and mudstone. The columnar structure and somewhat puffy "popcorn" surface of weathered mudstone and siltstone outcrops indicate the Tertiary sediments contain expansive clay minerals. The shallow Tertiary sediments resting on the weathered pre-Tertiary bedrock surface display considerable content of angular to sub-angular bedrock rubble present as coarse gravel in the basal Tertiary sediment.

1.2.4 Design and Construction History

The Jones Meadow Dam, originally known as the Bill Duce Dam, was designed for Mr. Bill Duce of Joelduken Ranch, Inc., by the Soil Conservation Service in 1963. The dam was constructed in 1964 by Lloyd Hanson and the construction was supervised by the Soil Conservation Service (SCS). The Lindberg Cattle Company, the present owner, purchased the ranch and dam in 1965.

The SCS had no records concerning the design or construction of the dam. What records were available were provided by the owner who had obtained them from the SCS office in Missoula, Montana. Available investigative information consisted of general gradation data on construction materials, SCS trip reports and memorandums addressing the site geology and foundation conditions. There is no information on shear strength of foundation or embankment materials and there is no stability analysis on file. A potential seepage problem in the left abutment is identified in preliminary design memos. Field inspection notes made in 1965, a year after construction of the dam, mention repairs to correct these seepage problems, but no details of the repair were available. The only available hydrologic or hydraulic information developed by the SCS is presented on the design drawings (Plate 3). The emergency spillway was designed to pass a flow of 106 cfs, resulting from a 6-hour, 100-year storm, with 2.5 feet of freeboard. The downstream conditions have not changed since the dam was built.

Chapter 2

INSPECTION AND RECORDS EVALUATION

2.1 HYDRAULICS AND STRUCTURES

2.1.1 Emergency Spillway

The emergency spillway for Jones Meadow Dam is located in natural ground of the left abutment (see plate 3 and photos 9-12). The spillway consists of an unlined chute excavated in bedrock and would be resistant to scour and erosion. The chute is a trapezoidal section 215 feet long with a 25-foot wide bottom and side slopes of 1V on 2H. The crest of the spillway is a 50-foot long level section located approximately 135 feet downstream from the entrance to the chute. The crest elevation is 4031.0 feet NGVD (119.0 feet project datum) which is four feet lower than the dam crest. The channel slopes and elevations shown on Plate 3 were verified during the inspection. The spillway chute discharges to a natural shallow depression about 138 feet downstream of the axis of the dam at an elevation about 27 feet higher than the natural stream channel and does not endanger the embankment. The shallow depression is not riprapped and there is no stilling basin at the stream channel. However, bedrock is exposed at or near the surface in the area of discharge and erosion would not be of concern.

The discharge rating for the spillway was developed by assuming that critical depth occurs at the 50-foot long level crest section near the axis of the dam. This was verified by backwater computations which were made using HEC-2 (Reference 4) beginning at the discharge section of the spillway and extending upstream through the spillway to the reservoir. With a Manning's "n" value of .032 the maximum discharge capacity of the spillway with the reservoir at the top of the dam, elevation 4035.0 feet NGVD (123 feet project datum) was estimated to be 550 cfs. The emergency spillway rating curve is presented on Plate 5.

The emergency spillway is in very good condition and according to the owner has spilled water only once or twice since 1965. There is no means of controlling debris at the spillway but no debris was observed in the reservoir or along its shore.

2.1.2 Outlet/Principal Spillway

The low level outlet works and the principal spillway for Jones Meadow Dam are located at approximately 60 feet from the right abutment and share a common outlet conduit. The principal spillway consists of a 24-inch diameter corrugated metal pipe riser which extends vertically through the embankment about 29 feet upstream of the axis of the dam. It connects as a drop inlet to the outlet conduit as shown on Plates 3 and 4. The principal spillway is an uncontrolled orifice with a fabricated conical shaped trash rack made of approximately half-inch rebar. The top of the riser pipe is at elevation 4029.2 feet NGVD (117.2 feet project datum) based on an assumed elevation of 4001.5 feet for the flowline of the outlet pipe at the toe of the dam. Measurements indicate that the riser pipe is 0.8 feet lower than indicated on the design plans and was probably constructed to this elevation.

The low level outlet is a 15-inch diameter CMP conduit on a slope of 0.02 foot per foot which is controlled at the inlet structure with a 15-inch diameter slide gate (see Plates 3 and 4). The intake structure could not be inspected due to the reservoir level and the outlet conduit was too small to allow inspection except at the point of discharge.

The slide gate is operated by means of a gate stem which extends up the face of the dam to a hand wheel mounted at the dam crest.

The discharge capacity of the low level outlet and the principal spillway is controlled by the capacity of their common outlet conduit and is negligible to the hydrologic routing evaluation of the reservoir. The maximum discharge capacity of the outlet with the reservoir elevation at the crest of the dam (4035.0 feet) would be about 17 cfs.

2.1.3 Freeboard

Because the dam overtops during the recommended spillway design flood (SDF; see paragraph 2.2.4), it has no freeboard. The vertical distance between the low point on the dam and the reservoir level at the time of the inspection was 6.8 feet. The emergency spillway crest is four feet below the low point on the dam crest. The crest elevation of the dam, as determined by field survey, varies 0.9 feet over its 275-foot length. The prevailing winds of the region are from the west, which would be directed away from the dam. For winds directed toward the dam from the southeast, the effective fetch for wind-generated waves is about 900 feet and wave runup on the embankment is estimated to be less than two feet. Although the dam will be overtopped during the SDF, the vertical distance between the dam crest and the normal reservoir level (at the principal spillway crest) is adequate to prevent overtopping the embankment by wind-caused waves.

2.2 HYDROLOGY, CLIMATOLOGY, AND PHYSIOGRAPHY

2.2.1 General

The climate of the area is continental in nature, characterized by warm summers and cold winters. The nearest climatological station (elevation 3620.0 feet NGVD) is at Potomac, about seven miles west of the center of the basin; however, only 16 years of records are available and those are incomplete. A climatological station is also located at Ovando, about 17.5 miles east northeast of the basin at elevation 4109.0 feet NGVD, which has 80 years of record. Mean annual precipitation at the Ovando station is 16.4 inches with 27% falling in the heaviest precipitation months of May and June. Mean February precipitation is 1.04 inches. Mean annual precipitation at the center of Caloma Creek (Jones Meadow) drainage basin is approximately 20 inches. Mean annual temperature at Ovando is 39.2° Fahrenheit (F), mean January temperature is 12.6° F, and mean July temperature is 61.3° F. May and June temperatures average 48.1° and 54.3° F respectively. Temperatures in the Caloma Creek basin probably average five to six degrees cooler than Ovando due to a slightly higher average basin elevation. Summer temperatures rarely exceed 100° F, and winter temperatures can reach 25 to 30 degrees below 0° F.

The drainage basin area for Jones Meadow Dam is 2.16 square miles and is generally bulb shaped. It is located on the western slopes of the Garnet Range and is steep and mountainous with basin elevations varying from 4035.0 feet NGVD at the dam to 5380.0 feet NGVD at Coyote Park in a stream length of 2.88 miles. Approximately 90% of the basin is forested and 10% open grassland. There are no USGS stream gages in the basin or in surrounding basins. The nearest gage site downstream is on the Blackfoot River near Bonner (123400) which lies approximately 25 river miles downstream of the dam. There is no means of measuring reservoir inflow, outflow or stage. There are no reservoirs or natural lakes in the basin.

2.2.2 Reservoir Storage and Spillway Discharge

The reservoir has a surface area of 15.8 acres and a storage of 133 acre-feet at the emergency spillway crest elevation 4031.0 feet NGVD (119.0 feet project datum). Approximately 76 acre-feet of surcharge storage is available in the reservoir between the emergency spillway crest and the dam crest. The emergency spillway discharge with the reservoir at the dam crest is 550 cfs, or about 45 acre-feet per hour. The principal spillway discharge with the reservoir at the dam crest is 17 cfs, or about 1.5 acre-feet per hour.

2.2.3. Estimated Probable Maximum Flood

The probable maximum flood (PMF) is the flood expected from the most severe combination of critical meterologic and hydrologic conditions that is reasonably possible in the region. An estimate of the PMF was made during this dam safety analysis and was routed through the reservoir.

The probable maximum precipition (PMP) was developed using procedures contained in the U.S. Weather Bureau's Hydrometerological Report No. 43 (Reference 5) as updated by U.S. Weather Bureau memorandum dated September 20, 1967 (Reference 6). The PMP produces 10.3 inches of rain in a 6-hour thunderstorm and 10.5 inches in a 72-hour general storm. A minimum loss rate of 0.15 inches per hour was assumed to represent the hydrologic class B soils in the basin and minimum infiltration conditions due to saturated ground. Baseflow was considered to be 10 cfs and snowmelt was not used in computation. The storm which produces the greatest PMF would be a 6-hour thunderstorm during the period July to August.

A triangular unit hydrograph for a 6-minute rainfall duration was developed for the 2.16 square mile drainage using procedures contained in Design of Small Dams (Reference 7). The Soil Conservation Service method of developing a curvilinear fit of the triangular unit hydrograph was used. The hourly increments of the PMP were arranged in a critical time sequence as illustrated in HMR No. 43 page 204 figure 6-1e (Reference 5). The two greatest hourly increments were rearranged in the reverse order of the unit hydrograph to produce the greatest possible peak. The PMP was applied to the unit hydrograph by means of the computer program HEC-1 (Reference 8). This estimate of the PMP produced a flood with a peak flow of 15,100 cfs and a volume of 1,040 acre-feet.

2.2.4 Flood Routing

Routing of the probable maximum flood through Jones Meadow reservoir was performed using the computer program HEC-1 Flood Hydrograph Package (Reference 8). The reservoir was assumed to be at the principal spillway elevation which is one foot below the elevation of the emergency spillway (4031.0 feet NGVD) at the beginning of the PMF. The principal spillway was not considered in the analysis because its capacity is insignificant compared to the flows of the PMF. The routing shows that the dam will be overtopped during the PMF when approximately 9% of the total flood volume enters the reservoir.

Routings were made of lesser hypothetical floods than the PMF to determine the magnitude of floods the dam can contain. The hypothetical hydrographs are obtained by applying percentages to the PMF ordinates. A flood with a hydrograph having ordinates corresponding to 12% of the PMF hydrograph ordinates is just controlled by the project. Larger floods would overtop the dam.

2.3 GEOTECHNICAL EVALUATION

The geotechnical evaluation presented herein is based on field inspection of the structure, SCS preconstruction design memos, SCS post construction memos regarding seepage problems, SCS design drawings, and interviews with the present operator.

2.3.1 Dam

The rolled earth dam is 275 feet long, 33.5 feet high (hydraulic height), and ranges from 15 to 17 feet in crest width. The downstream face as confirmed by field measurement is 1V on 2H and the exposed portion of the upstream face at the time of inspection is 1V on 3H. Preconstruction design memos by the SCS (Reference 9) and SCS design drawings (Plates 3 and 4) indicate the rolled earth embankment is a zoned earth fill consisting of a core of low plasticity sandy and silty clay protected by outer shells of "gravelly talus". The design drawings show the top of the core to be 14 feet wide at elevation 4035.0 feet NGVD with a downstream slope of 1V on 1H and an upstream slope of about 1V on 3H. The thickness of the upstream shell ranges from four to six feet.

Borrow materials for the core were obtained from Tertiary sediments on the left abutment area. Predesign memos by the SCS (References 10 and 11) indicate the Tertiary sediments ranged in composition from silty, clayey very fine sand to sandy or silty clay. Laboratory tests of the material determined a plasticity index of 6.6 which falls in the CL-ML soil group of the Unified Soil Classification system. Borrow for the outer shell material was obtained from the gravelly basal zone in the Tertiary sediments on the top of the hill forming the right abutment. Although the predesign memos refer to the gravelly material as "gravelly talus" (Reference 9) and suggest its use as a pervious filter blanket on the downstream face, field inspection reveals the material on the downstream face to consist of relatively impervious gravelly silty sandy clay.

The design drawings (Plate 4) indicate an original ground line profile and call out excavation of a core trench keyed to bedrock. The core trench design is for a trench with 1V on 1H slopes and an eight-foot wide bottom filled with "select materials". The drawings indicate that core trench depth was to be determined by the field engineer. No documentation of final core trench construction is provided; however, predesign memos (Reference 10 and 11) state that site investigations indicate an approximate depth of about five feet to bedrock in the core trench area. It is presumed that the "select" core trench material is the same as the core material used in the dam embankment.

Field inspection reveals the dam embankment to be in good repair. There is no evidence of differential settlement, disturbance, misalignment, accelerated erosion, or slope failure in the embankment. Although there is no riprap protection on the upstream face, the prevailing wind direction is away from the dam and wave erosion of the embankment was not evident.

2.3.2 Foundation Conditions, Seepage, and Drainage

The foundation of the dam consists of unconsolidated sand and gravel alluvium overlying bedrock. Preconstruction investigations suggested an estimated thickness of about five feet for the alluvium (References 10 and 11). The spillway foundation consists of hard siltite and quartzite bedrock. The outlet riser and conduit are founded in the alluvial sand and gravel materials according to design drawings and as shown by field relationships.

The July 17, 1980 field inspection did not detect any evidence of seepage in the right abutment or the alluvial foundation material. The elevation of the reservoir water surface at the time of the inspection was 116.3 feet project datum (approximately 4028.3 feet NGVD), 6.8 feet below the crest of the dam. A distinct demarcation in the density of grass vegetation on the downstream slope of the dam (Photo 6) about 11 feet above the toe at elevation 101.2 feet project datum (4013.2 feet NGVD) strongly suggests the presence of a zone of phreatic wetting below elevation 101.2 feet although the upper six inches of soil on the face of the dam was dry at the time of the inspection. Careful inspection of the embankment material around the outlet pipe at the downstream toe of the embankment revealed no evidence of seepage along the outlet.

At the time of the July 17, 1980 field inspection, an estimated 100 gpm was flowing from a zone in the left abutment in which the highest water exit level elevation was 105.3 feet project datum (4017.3 feet NGVD). This seepage zone was less than three feet thick vertically, four to five feet wide, (Photos 5 and 6) and appeared to be confined to fractured bedrock in the abutment and did not include any of the embankment material. The observed seepage that was existing from the jointed bedrock abutments is discussed in the predesign memos (References 9, 10 and 11) and was anticipated prior to construction of the dam. The seepage observed on July 17, 1980 was clear and free of sediment or tubidity.

Miscellaneous field notes of inspections of the dam by SCS personnel were provided by the owner. Eight entries were made from April 1965 to September 1965 which covered the first irrigation season following completion of the dam. The notes address the seepage in the left abutment area prior

to and immediately following the repair work. The seepage was again observed and noted on April 12, 1966, August 17, 1967, and for the last time on May 1, 1969. The notes do not clearly describe the extent of the initial seepage problem but do indicate piping occurred at the left abutment and repairs were made to that section of the embankment. The SCS was contacted concerning the notes and the present staff has no personal knowledge of the notes, the original seepage problem or the repair work. Exerpts from the field notes are quoted in the following paragraphs to document the exact description of the seepage problem as logged by the SCS personnel.

Anomynous field notes in the SCS post-construction data dated April 28, 1965 (Reference 12) refer to "3 large holes 7.8 feet below highest elevation water impounded to . . . 9.3 [feet] below top of drop inlet. Holes begin where embankment contacts south abutment and extend 12 feet north along face of dam." The notes state a "7-foot deep cut at the site at the leak on face of dam indicates all fines had been removed for depth of 2.5 feet then ML material (saturated) with stringers of very fine gravel for 2 feet below which ML was saturated to bedrock (shattered) at 7 [feet] depth from face of dam."

Field notes on April 20, 1965 (Reference 12) indicate "Reservoir is filled to within 1.5 feet of drop inlet" or about elevation 117.2 project datum (4029.2 feet NGVD). The field notes are not clear as to whether or not this is the initial filling of the reservoir. The field notes show that with the reservoir filled to about elevation 117 feet project datum (4029.0 feet NGVD), seepage pressures caused piping of embankment materials in the same location as the presently existing seep. The primary seepage path was probably through the jointed bedrock; however, the hydraulic gradient in the bedrock resulted in flows at the base of the overlying embankment with resultant piping.

Field notes dated June 28, 1965 indicate that repairs had been completed by that date. The repairs consisted of the placing of an upstream blanket of impervious soil on the upstream portions of the right and left abutments. Field notes written subsequent to emplacement of the upstream blanket indicate that the seep in the left abutment continued in the same location; however, the repairs reduced the hydraulic gradient sufficiently to reduce or eliminate seepage pressures in the embankment material and there was no evidence of piping in the embankment material above the seep during the July 17, 1980 inspection.

Field notes dated August 17, 1967 indicate that groundwater was flowing from the left abutment back through the upstream blanket into the empty reservoir. Therefore, it must be considered that seepage through the upstream blanket during periods of reservoir drawdown and drainage of bank storage in the abutment may have removed part of the upstream blanket and reduced the effectiveness of the blanket. Periodic observations of the seep in the left abutment bedrock indicate the rate of seepage has remained constant since about 1967 and the seepage rate is proportional to the reservoir level.

The available information (Reference 12) is insufficient to evaluate the potential for renewed piping of the embankment material through the left abutment during periods of high reservoir levels.

2.3.3 Stability

The external geometry and materials used in the zoned earth dam may conform to recommended guidelines with respect to stability for static loadings. Information available for Jones Meadow Dam is insufficient to support analytical evaluation of the embankment stability. There is no information on shear strength of foundation or embankment materials and there is no stability analysis on file. The location of the phreatic surface in the embankment is unknown except for the previously mentioned line of plant growth above the downstream toe.

2.4 PROJECT OPERATION AND MAINTENANCE

The facility is owned and operated by the Lindberg Cattle Company. Information on operations and maintenance was obtained from a discussion from Mr. Land Lindberg. The dam is visited routinely to make changes in outlet releases during the irrigation season.

2.4.1 Dam

There is no periodic maintenance plan and several small fir trees (two to four feet high) are growing on both faces of the dam and in the spillway. The Soil Conservation Service made site inspections to monitor the left abutment seep from the time the dam was built until the spring of 1969. No other inspections of the dam are on record.

2.4.2 Reservoir

The operational requirements of the reservoir are minimal. The low level outlet works is closed at the end of irrigation season and remains closed until needed which is usually late the next summer. Because of the low yield of the watershed the reservoir usually does not fill. The owner recalls that water has spilled over the emergency spillway only once or twice since its construction and many years the pool has never filled. Because the water is not used until July or August, much of it is lost to seepage and evaporation. The reservoir is not a primary water supply and its benefits to the owner are marginal.

2.4.3 Warning Plan

There is no formal warning plan in use in the event of impending dam failure.

CHAPTER 3
FINDINGS AND RECOMMENDATIONS

3.1 FINDINGS

Visual inspection of the dam, supplemented by analysis of the project in terms of the recommended guidelines, resulted in the following findings.

3.1.1 Size, Hazard Classification, and Safety Evaluation

In accordance with the recommended guidelines (Reference 1), the project is classified as small in size and has a high (Category 1) downstream hazard potential. The high hazard classification is due to the potential for economic loss and damage to a main highway. The risk of damage to inhabitable structures would be low. The recommended spillway design flood for this project is therefore one-half the PMF. Because the project can safely handle only a flood having hydrograph ordinates equal to 12% of the PMF hydrograph ordinates without overtopping and causing the dam to fail, Jones Meadow Dam is not in conformance with inspection guidelines.

3.1.2 Embankment Dam

A visual inspection of Jones Meadow Dam revealed no longitudinal or transverse cracking. The downstream slope was uniform with no irregularities. A few scattered, small trees were present on the upstream and downstream slopes and in the emergency spillway channel. The reservoir level at the time of the inspection was 6.8 feet below the dam crest which corresponds to reservoir elevation 116.3 feet project datum (4028.3 feet NGVD). There is no wave erosion on the upstream slope and wave action would be directed away from the dam by the prevailing winds.

A seep estimated to be 100 gallons per minute emerges from the bedrock about 15 feet downstream of the left abutment contact at an elevation of 105.3 project datum. The seep has existed since the first filling of the reservoir in 1964 and resulted in some loss of embankment material due to piping through the bedrock as evidenced by several sink holes described in field notes on file with the SCS. In 1965 the SCS drained the reservoir and placed an impervious blanket over the left abutment area in the reservoir to seal the seep. The blanket was not entirely effective and the seep continued at a reduced rate. The seep was monitored by the SCS through 1969 and no changes in the seepage conditions were noted. The seeping water was clear and there was no indication of piping on the date of inspection.

The effects of the seepage condition on the embankment are unknown. Insufficient information is currently available for evaluation of embankment stability. There is no information on the shear strength of the foundation or embankment materials and there is no stability analysis on file. The location of the phreatic surface in the embankment is unknown.

3.1.3 Spillway and Reservoir Capacity

The reservoir has a surface area of about 15.8 acres and a storage capacity of 133 acre-feet at the emergency spillway crest, elevation 119.0 feet project datum. Approximately 76 acre-feet of surcharge is available elevation of the top of the riser pipe and the crest of the dam. The combined discharge of the principal and emergency spillways, with the reservoir at the dam crest, is about 570 cfs.

Inspection guidelines (Reference 1) recommend that a dam of small size and high downstream hazard potential be capable of safely handling a flood in the range of one-half PMF to a full PMF. Because of the relatively low risk to inhabitable structures (two or less inhabitable structures to which dam failure may cause damage) it is recommended that the dam safely pass one-half the PMF. An estimate of the PMF indicates that the dam will be overtopped during the PMF when approximately 9% of the total PMF volume enters the reservoir.

3.1.4 Outlet/Principal Spillway

The outlet works appeared to be in good condition. The outlet conduit was not inspected because of its small size. The outlet gate was operated through its full range and is in good working order.

The outlet conduit will operate as a pressure conduit when the reservoir is above elevation 118.0 feet project datum. Consequently, it is possible that the conduit, which extends through the earthen embankment, would be pressurized for several days during a major flood event with no means to facilitate emergency closure at the drop inlet.

3.1.5 Operations and Maintenance

The outlet works usually remain shut until water is needed in July or August. Due to the generally low yield of the basin, the reservoir usually does not fill to the principal spillway crest. Seepage and evaporation losses sometimes deplete a significant portion of the available water. The Soil Conservation Service visited the site annually until 1969 to monitor the seep area. Since 1969 there is no record of periodic inspections. No debris was observed in the reservoir or along its shore. There is no formal downstream warning plan for use in the event of impending dam failure.

Trees and brush growing on the embankment and in the emergency spillway channel create an ongoing maintenance need.

3.2 RECOMMENDATIONS

Due to storage between the principal spillway crest and the dam crest, the present project provides a degree of flood protection to the downstream area. The intent of report recommendations is to maintain or improve project safety, if feasible, without decreasing this flood protection.

The findings suggest that high priority be given the following recommendations:

1. Immediately develop, implement, and periodically test an emergency warning plan for use in the event of impending dam overtopping or structural failure.

2. Remove the few scattered trees, root systems, and brush from the embankment, toe areas, abutments, and spillway. Backfill and compact all depressions.

3. Inspect the low-level outlet gate and conduit and repair it, if required.

4. Inspect the condition of the impervious blanket seal, placed on the upstream face of the left abutment to control seepage and determine if it is functioning as intended. Note any changes in seepage conditions.

5. Conduct and place on file a stability analysis of the dam embankment. This analysis should be performed by qualified geotechnical engineers.

6. Conduct more detailed hydrologic and hydraulic routing studies to better determine the downstream hazard and required spillway capacity, and modify the project as studies indicate.

7. Conduct inspections of Jones Meadow Dam at least once every five years by engineers experienced in dam design and construction.

8. Consider providing for emergency closure capability of the principal spillway conduit at the riser.

9. Prepare and implement a formal operating and maintenance plan.

Prior to performing engineering studies and remedial construction, all work should be coordinated with the State of Montana, Department of Natural Resources and Conservation to insure compliance with all pertinent laws and regulations.

REFERENCES

1. U.S. Department of the Army, 1975, National Program of Inspection of Dams, Vol. 1, Appendix D, Recommended Guidelines for Safety Inspection of Dams: U.S. Corps of Engineers, Office of the Chief Engineer's Report to Congress, Washington, D.C.

2. American Commission on Stratigraphic Nomenclature, 1961, Code of stratigraphic nomenclature: American Assoc. Petroleum Geologists Bull., v. 45, p. 645-665.

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4. U.S. Department of the Army, 1976, HEC-2 water surface profiles, generalized computer program, users' manual with supplement: Hydrologic Engineering Center, Corps of Engineers, Davis, California

5. U.S. Weather Bureau, 1966, Hydrometeorological Report No. 43, Probable maximum precipitation, northwest states.

6. U.S. Weather Bureau, 1967, Memorandum: probable maximum thunderstorm rain for the Columbia river basin east of the Cascade ridge: Office of Hydrology, Hydrometeorological Branch.

7. U.S. Department of the Interior, 1978, Design of small dams, 3rd ed: Bureau of Reclamation, Denver, Colorado, 816 p.

8. U.S. Department of the Army, 1978, Flood hydrograph package (HEC-1) - users' manual for dam safety investigations: Hydrologic Engineering Center, Corps of Engineers, Davis, Calif., 93 pp.

9. Gemmell, B.B., April 15, 1963, Memo to William H. Cardon regarding predesign considerations - Bill Duce Dam proposed: Soil Conservation Service Memo, Asst. State Cons. Engineer, Bozeman, Montana.

10. Smith, H.R., July 12, 1962, Letter to Mr. Bill Duce regarding damsite investigation and construction materials: Soil Conservation Service Trip Report, SCS Geologist, Missoula, Montana.

11. Smith, H.R., November 9, 1962, Letter to Mr. William Duce regarding additional engineering materials investigations and design considerations: Soil Conservation Service Trip Report, SCS Geologist, Missoula, Montana.

12. Anonymous, April 20, 1965 to August 17, 1967, Field notes regarding leak at south abutment and repair efforts: Soil Conservation Service deactivated files obtained from Mr. Land Lindberg.

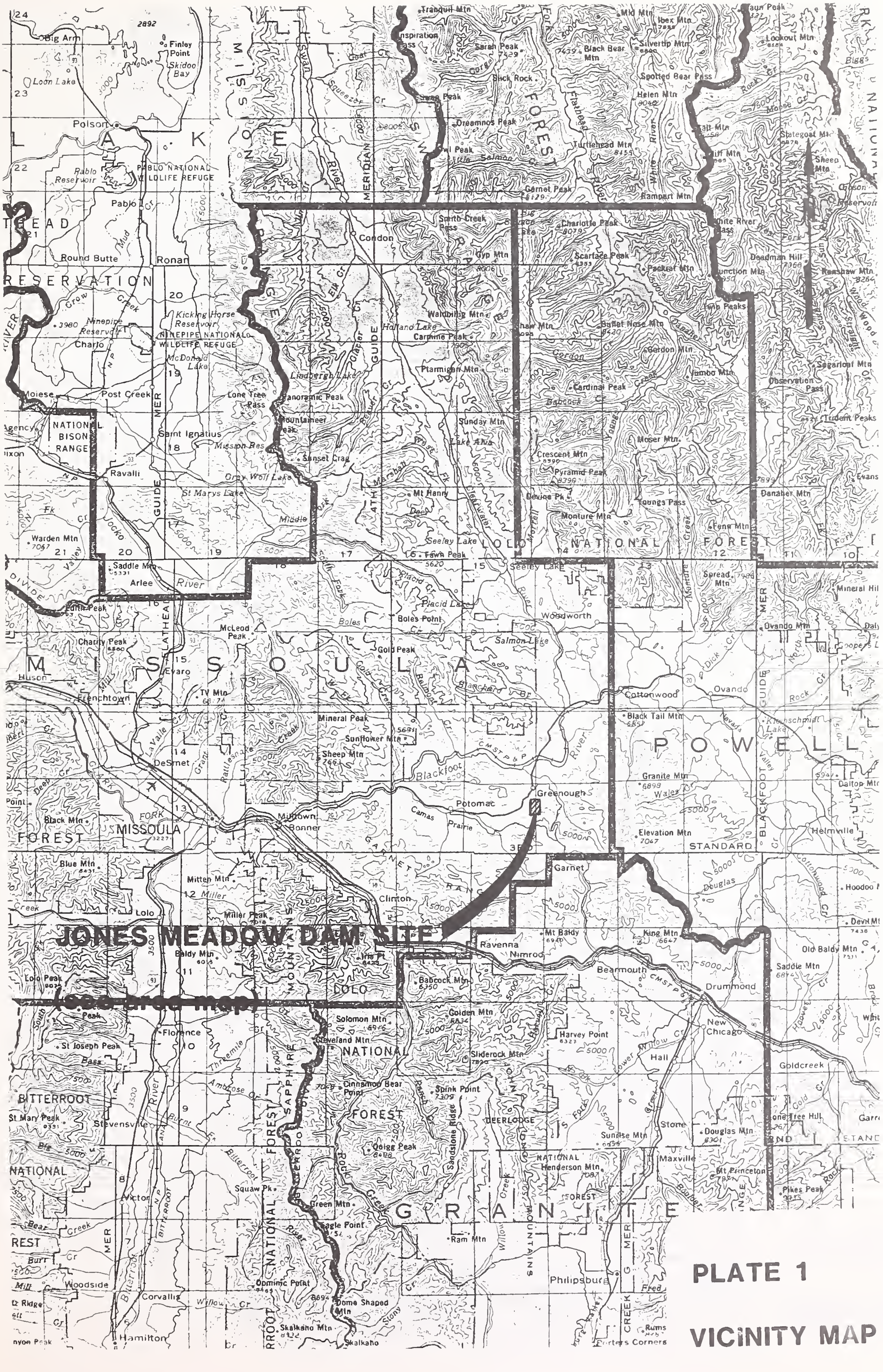


PLATE 1
VICINITY MAP

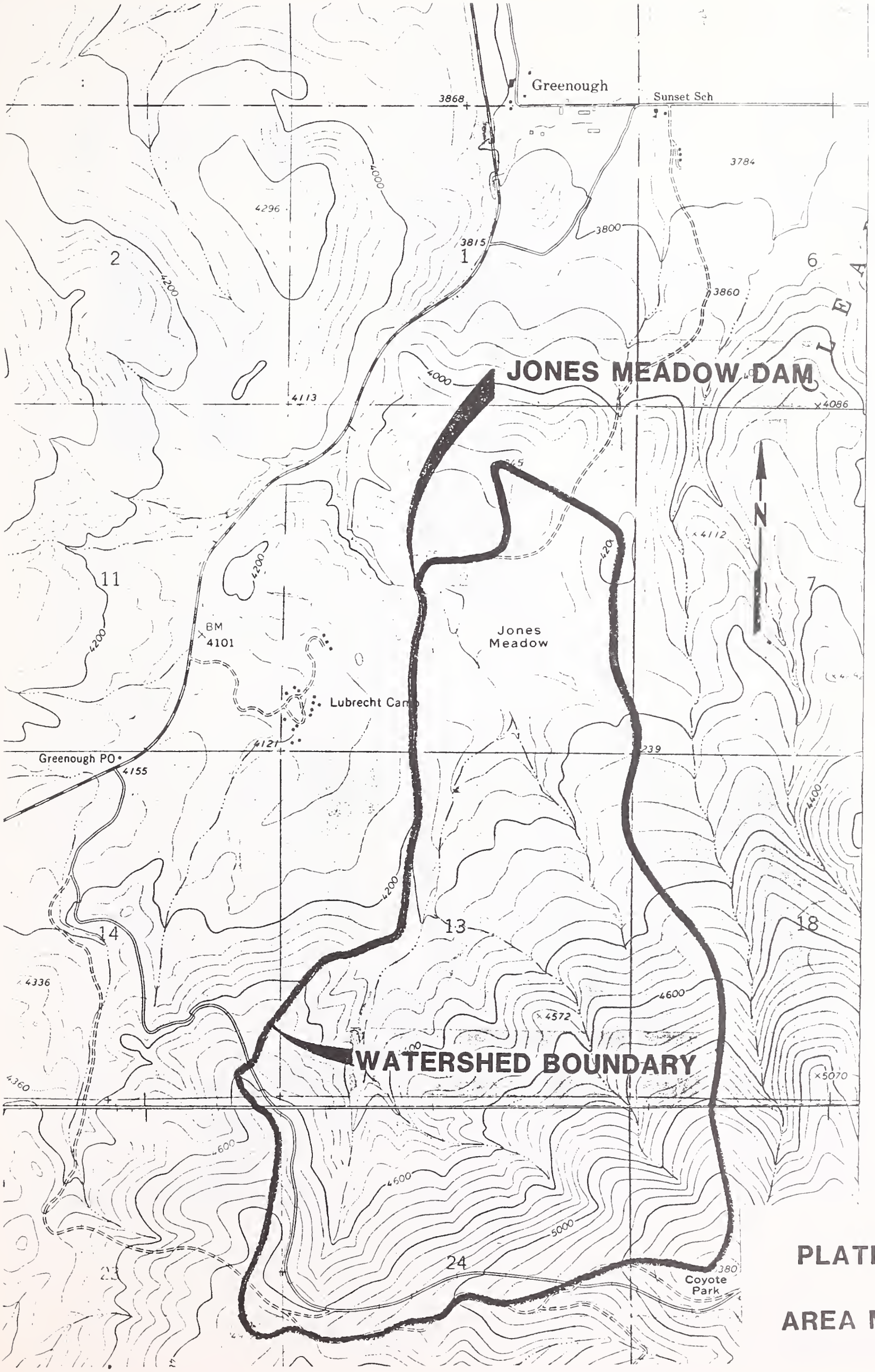
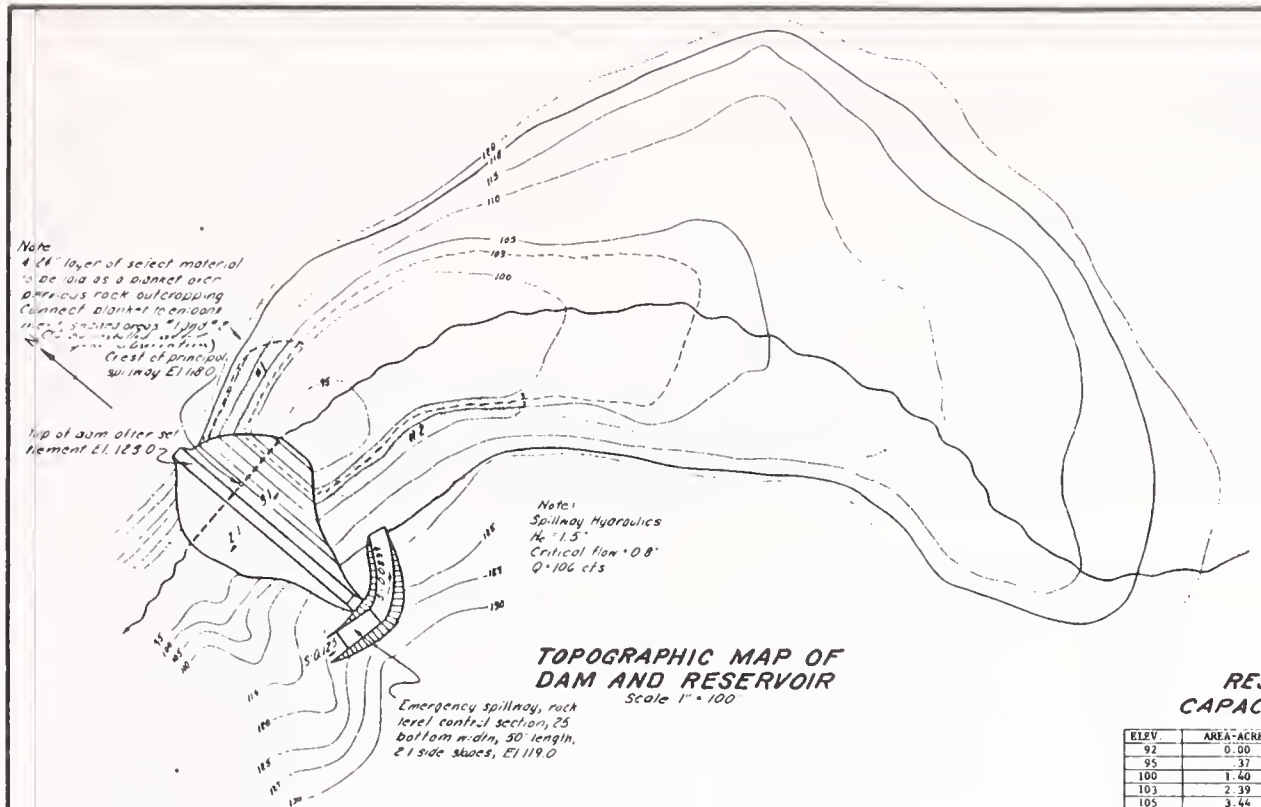


PLATE 2

AREA MAP



TOPOGRAPHIC MAP OF DAM AND RESERVOIR

Scale 1" = 100

HYDROLOGIC DATA OF WATERSHED

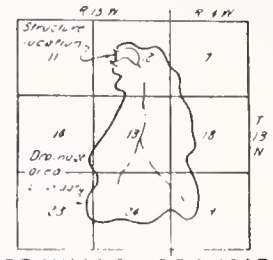
LAND USE	CONDITION OR PRACTICE	HYDROLOGIC SOIL GROUP	SOIL COVER COMPLEX	PERCENT OF AREA	COMPLEX NO. X AREA
GRASS	FAIR	B	69	5	345
WOOD	MED. POOR	B	64	95	6080
			TOTALS	100	6425

WEIGHTED SOIL COVER COMPLEX NO. IS $\frac{\text{TOTAL COL. 6}}{\text{TOTAL COL. 5}} = \frac{6425}{100} = 64.25$

PEAK FLOW COMPUTATION

T.C. = $\frac{\text{LENGTH OF DRAINAGE AREA}}{\text{AVERAGE VELOCITY} \times 3600} = .35$ HOURS

RAINFALL (6 HOURS) 100 YEAR FREQ. = 2.00 INCHES
DIRECT RUNOFF (R) = .10 IN RAINFALL
UNIT PEAK DISCHARGE (g) = 297 cfs/SQ. MI. OF AREA
PEAK DISCHARGE (Q) = 297 g X $\frac{2300A}{640}$ X .10 R = 106 cfs



DRAINAGE AREA MAP

Scale 1" = 1 mile

DRAINAGE AREA DATA

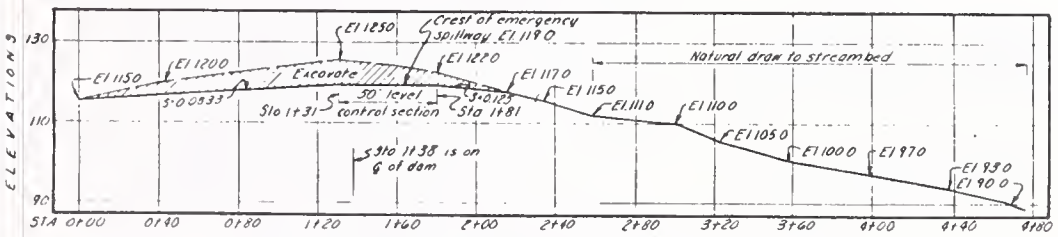
ACRES WOODLAND	2,170
ACRES GRASSLAND	130
TOTAL ACRES IN AREA	2,300
TYPE OF SOIL	SOIL GROUP B
LENGTH OF DRAINAGE AREA	12,600'

RESERVOIR CAPACITY TABLE

ELEV.	AREA-ACRES	ACRE FEET	TOTAL	
92	0.00	0.0	0.0	
95	.37	0.6	0.6	
100	1.40	4.4	5.0	
103	2.39	5.7	10.7	
105	3.44	5.9	16.6	
110	6.08	23.8	40.4	
115	9.85	39.8	30.2	
117	13.42	23.3	103.5	
118	15.00	14.2	117.7	← TOP OF RISER
119	15.80	15.4	133.1	← EMERG. SPLWY.

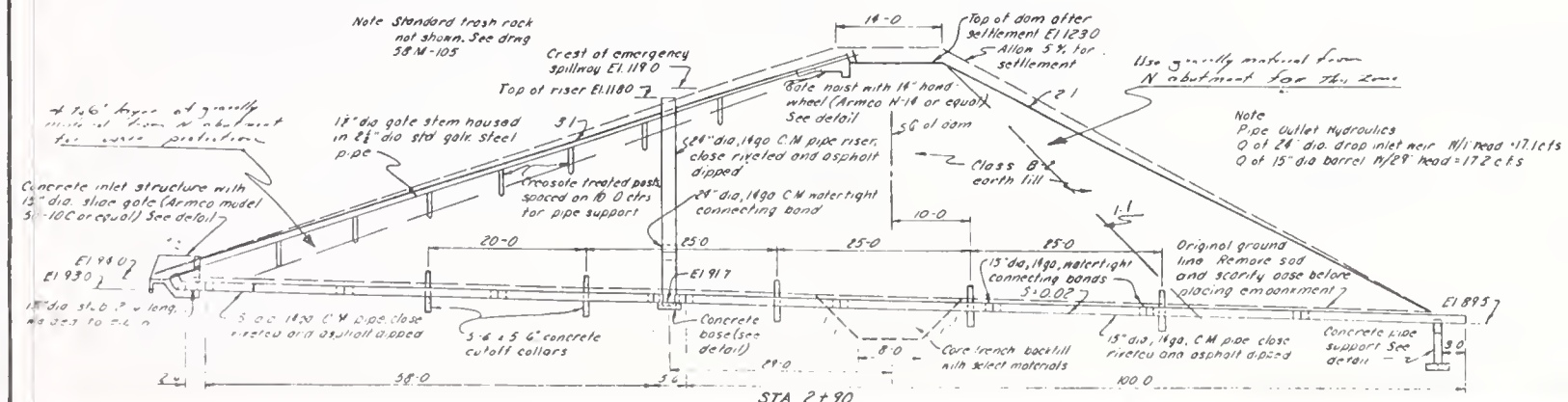
TABLE OF QUANTITIES

ITEM NO.	ITEM	UNIT	QUANTITY	
1.	EMBANKMENT: CLASS 3-2 - EARTH FILL - DAM PROPER	CU YD.	14,186	-13,702
2.	CLASS 3-2 - ABUTMENT BLANKET - 24" DEEP (To Be Installed After Construction)	CU YD.	1,350	—
3.	EXCAVATION: FOUNDATION STRIPPING - 12" DEEP	CU YD.	1,200	— 809
	CORE TRENCH	CU YD.	700	11705
4.	CONCRETE (CLASS B)	CU YD.	6.62	
5.	REINFORCING STEEL 564 LIN. FT	LBS.	377	
6.	TRASH RACK FOR DROP INLET PER STD DRWG 58M-105 SEE DETAIL	EACH	1	
7.	RISER 24" DIA , 14 GA. C.M PIPE, 27' LONG, (CONSISTING OF 2 PIECES OF PIPE AND ONE CONNECTING BAND) WITH TWO 15" DIA , 14 GA C.M PIPE TEES, 2'-0" LONG, WELDED TO 1T 9" FROM THE END. ALL C.M. PIPE TO BE CLOSE RIVETED AND ASPHALT DIPPED	EACH	1	
8.	PIPE C.M. 15" DIA 14 GA. CLOSE RIVETED ASPHALT DIPPED	LIN FT.	158	
9.				
10.	WATERTIGHT CONNECTING BANDS 15" DIA 14 GA X 2' WIDE ASPHALT DIPPED	EACH	9	
11.	POSTS, CREOSOTE TREATED W/METAL STRAPS FOR PIPE SUPPORT	EACH	7	
12.	GATE, METAL SLIDE 15" DIA. 50-100 W/METAL GATE FRAME	EACH	1	
13.	GATE, LIFTING MECHANISM, APPROX 94' OF 1¼" DIA CATE STEM, 90' of 2½" DIA. GALVANIZED PIPE, STEM SPLICES, COUPLINGS AND OIL SEAL AND HAND-WHEEL LIFT (ARMCO MODEL M-24 OR EQUAL)	LUMP SUM		
14.	METAL ELBOW FORM - 15" DIA. (SEE DETAIL), W/15" DIA. STUB, 2'-6" IN LENGTH, WELDED TO ELBOW	EACH	1	



PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

Scales Horiz 1" = 40'; Vert 1" = 20'



CROSS SECTION OF DAM ALONG ℄ OF PRINCIPAL SPILLWAY

STA. 2+90

Scale 1" = 10'

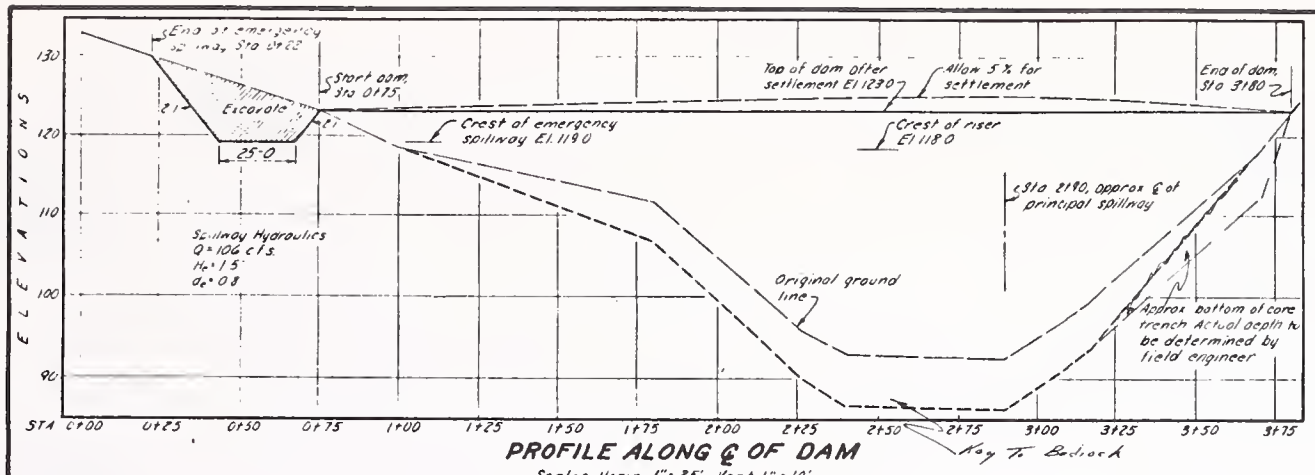
JOELDUKEN RANCH, INC. IRRIGATION STORAGE DAM

Sec 12, T 13 N, R 13 W
Missoula County, Montana

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

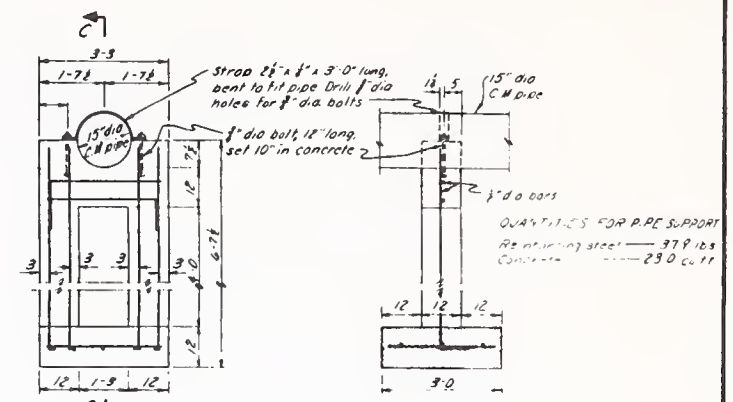
Designed CLW/TMM Date 1-69
Drawn
Traced
Checked
Approved by L. H. Swartz
Title State Conservation Engineer
Title
Sheet No 1 of 2
Drawing No. 5.E-19,114

PLATE 3



PROFILE ALONG ℄ OF DAM

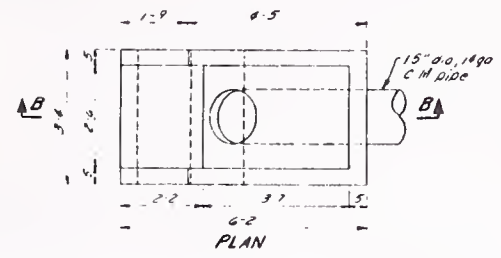
Scales: Horiz. 1" = 25', Vert 1" = 10'



ELEVATION SECTIONAL ELEVATION C-C

DETAILS OF CONCRETE PIPE SUPPORT

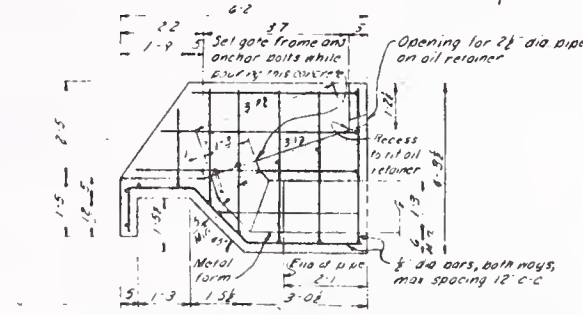
Scale ½" = 1'-0



PLAN

QUANTITIES FOR INLET STRUCTURE
Reinforcing steel —— 102.2 lbs
Structural steel (trash rack) —— 17.3 lbs
Concrete —— 43.8 cu ft

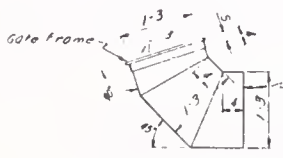
Note Trash rack for inlet not shown. For details use Standard Structure D Drawing No 3,R-10,000-10 sheet 3 of 7



SECTIONAL ELEVATION B-B

DETAILS OF INLET STRUCTURE

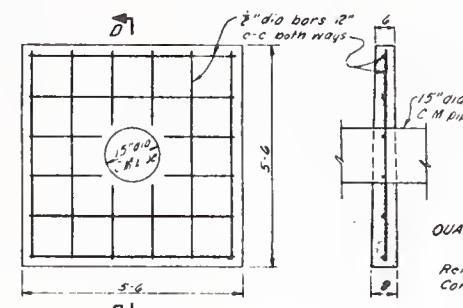
Scale ½" = 1'-0"



Note Obtain 'S' (depth of gate frame embedded in concrete) from gate manufacturers plan

DETAIL OF 3 PIECE METAL ELBOW FORM

Scale ½" = 1'-0"

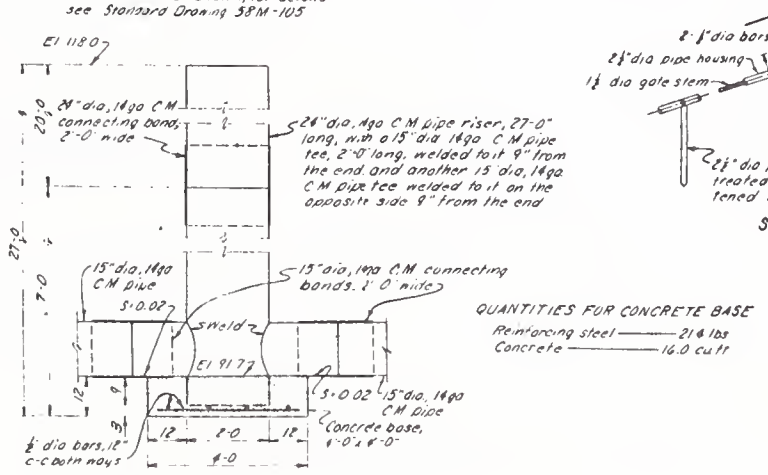


ELEVATION SECTIONAL ELEVATION D-D

QUANTITIES FOR ONE CUTOFF COLLAR
Reinforcing steel —— 38.1 lbs
Concrete —— 16.6 cu ft

DETAILS OF CONCRETE CUTOFF COLLAR

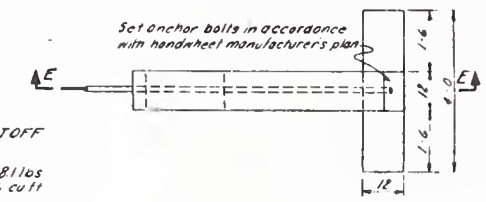
Scale ½" = 1'-6"



QUANTITIES FOR CONCRETE BASE
Reinforcing steel —— 21.6 lbs
Concrete —— 16.0 cu ft

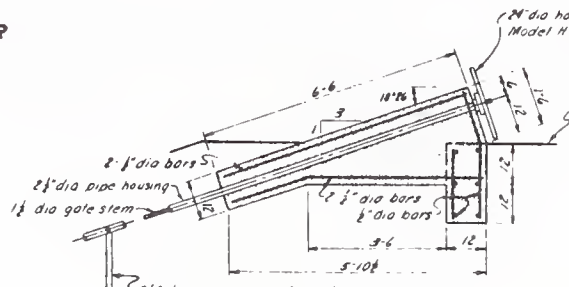
DETAILS OF DROP INLET

Scale ½" = 1'-0

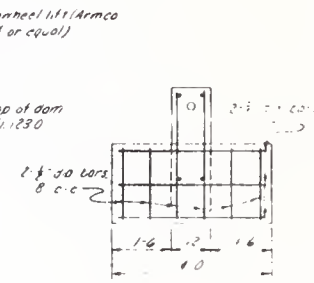


PLAN

QUANTITIES FOR GATE HOIST
Reinforcing steel —— 42.5 lbs
Concrete —— 17.1 cu ft



SECTIONAL ELEVATION E-E



DETAILS OF GATE HOIST

Scale ½" = 1'-0

JOELDUKEN RANCH, INC.
IRRIGATION STORAGE DAM

Sec 12, T 13 N, R 13 W
Missoula County, Montana

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed CLW/TNM	Date 1/63	Approved by E N Swerry	
Drawn		Title	
Traced		Title	
Checked	1/63	Sheet No 2 of 2	Drawing No 5, E-19, 114

PLATE 4

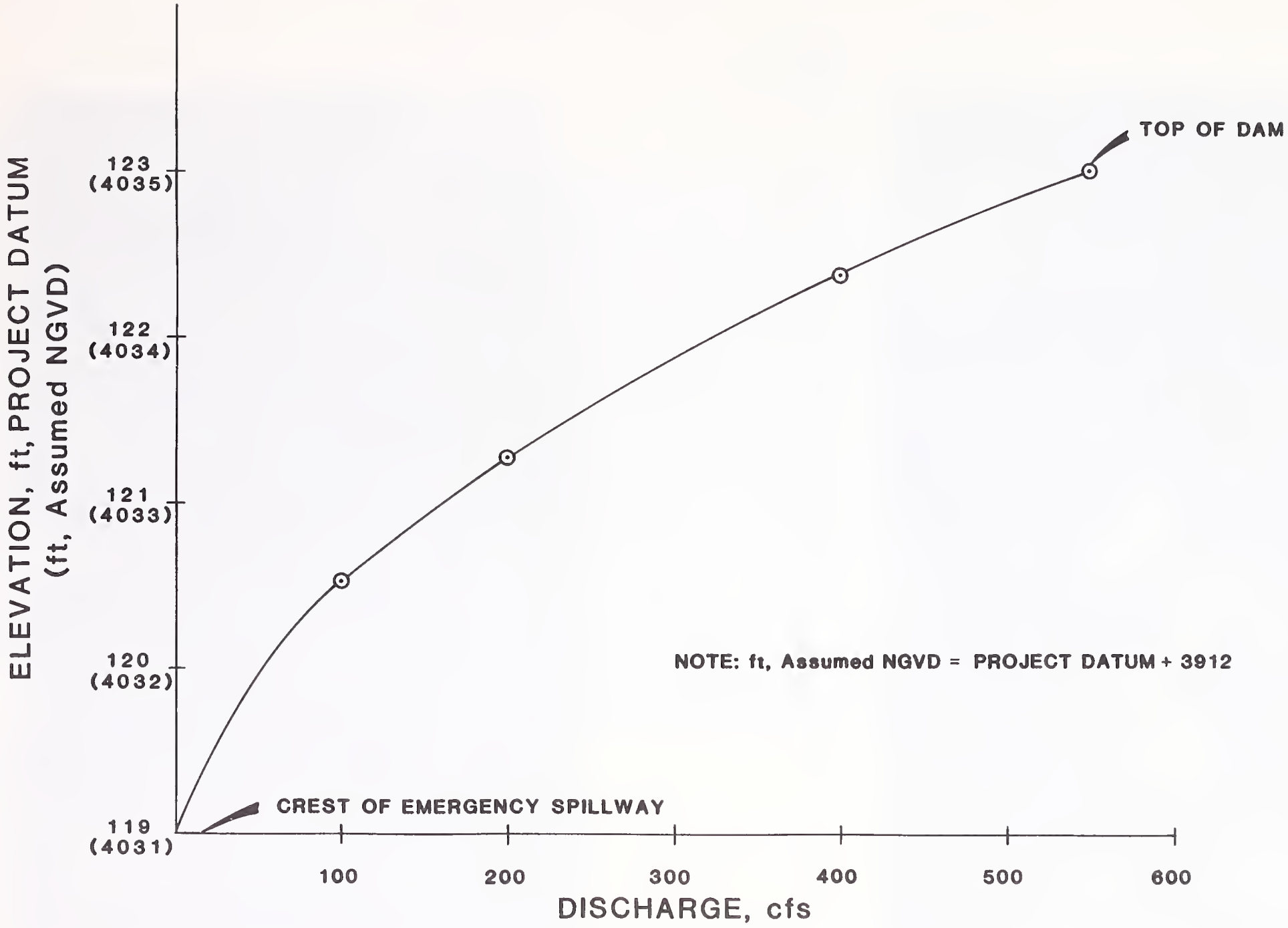


PLATE 5

EMERGENCY SPILLWAY DISCHARGE RATING CURVE

JONES MEADOW DAM

Photo 1 Aerial view of Jones Meadow Dam and Reservoir

Photo 2 Aerial view of Greenough Area Downstream of Dam

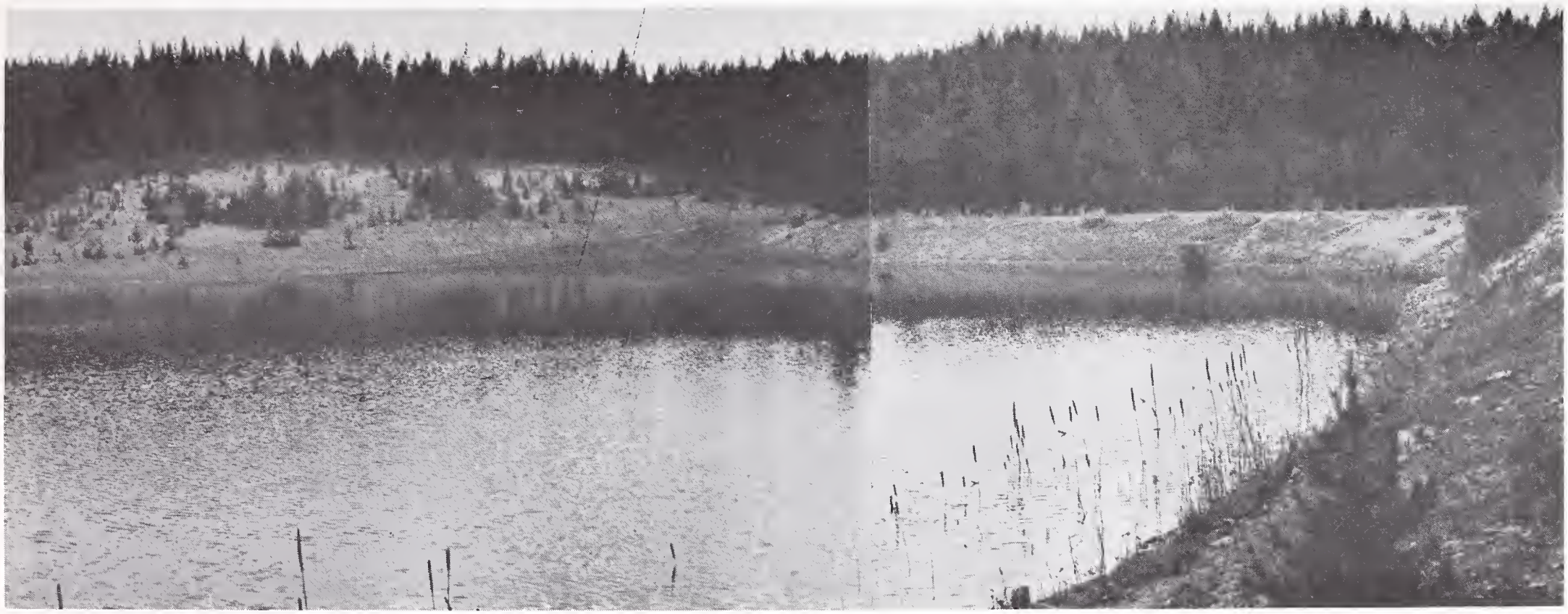


Photo 3 Upstream slope of Dam looking toward south abutment and spillway approach

Photo 4 Downstream slope of Dam

Photo 5 Downstream slope of Dam and channel area. Note seep area at south abutment

Photo 6 Seep area at south abutment. Note vegetative line along face of dam

Photo 7 North abutment area upstream

Photo 8 North abutment area downstream

Photo 9 Spillway approach channel looking toward Reservoir from axis of Dam

Photo 10 Spillway channel looking downstream. Man standing on centerline of Dam crest

Photo 11 End of spillway chute where it discharges to natural draw

Photo 12 Looking up the natural draw to the spillway channel

Photo 13 Principal spillway riser pipe and gate control wheel

Photo 14 Outlet pipe at toe of Dam

APPENDIX

Correspondence

DEPARTMENT OF NATURAL RESOURCES
AND CONSERVATION
WATER RESOURCES DIVISION

TED SCHWINDEN, GOVERNOR

32 SOUTH EWING

STATE OF MONTANA

(406) 449-2872 ADMINISTRATOR
(406) 449-3962 WATER RIGHTS BUREAU
(406) 449-2872 WATER SCIENCES BUREAU
(406) 449-2864 ENGINEERING BUREAU
(406) 449-2872 WATER PLANNING BUREAU

HELENA, MONTANA 59620

March 27, 1981

Department of the Army
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Wa 98124

Attn: Ralph Morrison

Dear Ralph:

Re: Morrison-Maierle, Inc. Dam Safety Inspection Report
of Jones Meadow Dam MT-1159.

We have reviewed the above referenced final draft report. We concur with the findings and recommendations and find that it satisfies the criteria of Phase I report.

Minor editorial comments have been discussed with your staff, and we understand these will be incorporated in the final report.

Thank you for this opportunity to review and comment on the final draft report on Jones Meadow Dam.

Sincerely,

Richard L. Bondy

Richard L. Bondy, P.E.
Chief, Engineering Bureau

RB:AT:lz

United States
Department of
Agriculture

Soil
Conservation
Service

P.O. Box 970
Bozeman, MT
59715

March 26, 1981

Sidney Knutson, P.E.
Assistant Chief
Engineering Division
Seattle District Corps of Engineers
P.O. Box C-3755
Seattle, WA 98124

Dear Mr. Knutson:

Thank you for the opportunity to review the final draft report on Jones Meadow Dam (MT-1159).

Our comments relating to specific report statements are:

Page 11, last line: It is not clear whether or not the riser pipe elevation is thought to be at design elevation or 0.8 feet lower.

General Comments:

Except for the meteorology, hydrology, and possibly the hazard classifications, we feel the report is an accurate statement of the dam and its condition.

We do not feel the meteorologic and hydrologic conditions used to develop the PMF are realistic. The conditions and criteria selected attempt to eliminate the element of risk to a degree that is not reasonable or practical.

We request that the meteorologic and hydrologic assumptions and conditions be fully presented and justified in the report.

We urge that a breach flood routing and thus a substantiated hazard classification be made in the Phase I inspection. With such a brief field overview, general hydrologic modeling and a subjective hazard analysis, the report is forcing the, as yet unjustified, economic burden of a Phase II inspection on the dam owners.

Sincerely,

Van K Haderlie
State Conservationist

cc:
Ray Smith, State Conservation Engineer, SCS, Bozeman

MORRISON-MAIERLE, INC
QUALITY ASSURANCE

Project Manager

Branch Manager or Department Head

Peer Reviewer

Principal-In-Charge

Chief Engineer No.	Date Approved
	4-23-81

Project No. 1447-09-02-33